

# ***The Ultimate ARF***



**Wingspan:** 60.5 in [1535mm]

**Wing Area:** 1250 in<sup>2</sup> [80.6dm<sup>2</sup>]

**Weight:** 11.75 – 12 lb [5330 – 5445g]

**Wing Loading:** 22 oz/ft<sup>2</sup> [67g/dm<sup>2</sup>]

**Length:** 66 in [1675mm]

**Radio:** 5-channel minimum

**Servos:** (6) Futaba 9001 servos, (1) Futaba 9202 servo (rudder),

(1) Futaba 3003 servo (throttle)

**Engine** .90 – 1.20 cu in [15 – 20cc] two-stroke,  
1.20 – 1.50 cu in [20 – 25cc] four-stroke

## **INSTRUCTIONS**

Welcome to the world of **Ultimate** flying! Now that you're an experienced R/C pilot, you're ready to step up to a higher level of aerobatic flying. And we've made sure this ARF version won't disappoint. With the same flight characteristics as the kit version, you'll soon know why the **Carl Goldberg Products Ultimate** has been America's favorite sport biplane since 1990.

### **LIMITED WARRANTY**

**Carl Goldberg Products Ltd.** has inspected and certified the components of this aircraft. The company urges the buyer to perform their own inspection, prior to assembly, and to immediately request a replacement of any parts they believe to be defective for their intended use. The company warrants replacement of any such components, provided the buyer requests such replacement within a period of 90 days from the date of purchase and provided the defective part is returned, if so requested by the company.

No other warranty, expressed or implied, is made by the company with respect to this kit. The buyer acknowledges and understands that it is their responsibility to carefully assemble the finished flying model airplane and to fly it safely. The buyer hereby assumes full responsibility for the risk and all liability for personal or property damage or injury arising out of the buyer's use of the components of this kit.

**If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to return this kit immediately in new and unused condition to the place of purchase.**

To make a warranty claim send the defective part or item to Hobby Services at the address below:

Hobby Services  
3002 N. Apollo Dr., Suite 1  
Champaign, IL 61822 USA

Include a letter stating your name, return shipping address, as much contact information as possible (daytime telephone number, fax number, e-mail address), a detailed description of the problem and a photocopy of the purchase receipt. Upon receipt of the package, the problem will be evaluated as quickly as possible.

**READ THROUGH THIS MANUAL BEFORE STARTING CONSTRUCTION. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.**



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## TABLE OF CONTENTS

<b>REQUIRED ITEMS</b> .....	2
Engine.....	2
Radio Equipment .....	2
Tools & Building Supplies.....	2
<b>PREPARE FOR ASSEMBLY</b> .....	3
<b>WING CONSTRUCTION</b> .....	3
Hinge the Ailerons.....	3
Servo & Control Horn Installation .....	4
Wing Dowel Installation.....	6
<b>FUSELAGE CONSTRUCTION</b> .....	6
Stabilizer & Fin Installation.....	6
Flying Wires Installation .....	7
Hinge the Tail Control Surfaces.....	9
Elevator Servo & Control Installation .....	9
Rudder Servo & Control Installation.....	11
<b>ENGINE INSTALLATION</b> .....	13
Fit the Engine.....	13
Trim the Cowl .....	14
Throttle Pushrod & Servo Installation .....	14
<b>RADIO INSTALLATION</b> .....	15
<b>FUEL TANK &amp; BATTERY INSTALLATION</b> .....	16
Fuel Tank Assembly .....	16
Mount the Fuel Tank & Battery.....	16
<b>LANDING GEAR INSTALLATION</b> .....	18
Main Landing Gear Installation .....	18
Tail Wheel Installation & Rigging.....	19
<b>FINAL ASSEMBLY</b> .....	20
Install the Cowl & Propeller.....	20
Wing Installation.....	21
<b>SETTING CONTROL THROWS &amp; DIRECTION</b> .....	22
<b>C.G. BALANCING</b> .....	23



## REQUIRED ITEMS

### ENGINE

The Carl Goldberg Products Ultimate was designed to fly on the engines listed below. Using an engine outside of the range listed is not recommended, nor can we be responsible for any resulting damages. If you decide to use an engine outside of this range, you must take extra precautions to strengthen your model to handle the extra loads.

- ☐ 2-Stroke: .90 – 1.20 cu in [15 – 20cc]
- ☐ 4-Stroke: 1.20 – 1.50 cu in [20 – 25cc]

In order to complete the model, you will also need a 3-1/2" [89mm] spinner. We suggest Tru Turn's® 3-1/2" Ultimate aluminum spinner.

You will also need:

- ☐ (4) 8-32 x 1-1/4" [32mm] SHCS bolts (GPMQ3050)
- ☐ Fuel plug "dots" (GPMQ4166)
- ☐ Standard fuel clunk (DUBQ0637)
- ☐ A suitable Pitts-style muffler

If you're going to use a three line fuel tank you'll also need a second fuel clunk and a "fuel dot" stopper plug for the fill line.

### RADIO EQUIPMENT

A 5-channel radio system with seven standard servos is required for this plane. Below is a list of standard case size servos we recommend. **Note:** The second elevator servo must be reversed.

- ☐ (6) Futaba® 9001 OR minimum 54 oz-in torque standard size servos (FUTM0075)
- ☐ (1) Futaba 9202 (rudder servo) standard size (FUTM0090)
- ☐ (1) Futaba 3003 standard size servo (for throttle) (FUTM0031)
- ☐ (2) Y-harnesses (FUTM4130 or FUTM4135 for digital servos)
- ☐ (1) Hobbico® Heavy Duty Y-Harness (HCAM2751)
- ☐ (1) Hobbico Heavy Duty Switch Harness – Futaba J type (HCAM2761)
- ☐ (4) 12" [300mm] Servo extension (HCAM2711 for Futaba)
- ☐ (2) 24" [610mm] Servo extension (HCAM2721 for Futaba)

### TOOLS & BUILDING SUPPLIES

- ☐ 1/2 oz. [15g] Thin Pro™ CA (GPMR6001)
- ☐ 1/2 oz. [15g] Medium Pro CA+ (GPMR6007)
- ☐ Denatured alcohol
- ☐ Drill bits: 1/16" [1.6mm], 5/64" [2mm], 3/32" [2.4mm], 5/32" [4mm], 7/32" [5.6mm]
- ☐ #1 Hobby knife (HCAR0105)
- ☐ #11 Blades (5-pack, HCAR0211)
- ☐ Hobbico Steel T-Pins 1" (100) (HCAR5100)
- ☐ Great Planes® Pro™ Threadlocker (GPMR6060)
- ☐ CA applicator tips (HCAR3780)
- ☐ 220-grit Sandpaper
- ☐ Bru Line hemostat – curved 5-1/2" (BRUR1303)
- ☐ Metric & standard ball-end hex drivers
- ☐ 36" Metal ruler (HCAR0475)
- ☐ 18" Flexible steel rule (HCAR0460)
- ☐ Builder's Triangle Set (HCAR0480)
- ☐ Pliers with wire cutter (HCAR0625)
- ☐ Hobbico heavy duty diagonal cutter 7" (HCAR0627)
- ☐ Rotary tool such as Dremel®
- ☐ Rotary tool reinforced cut-off wheel (GPMR8200)
- ☐ Masking tape (TOPR8018)
- ☐ Hobbico Retractable Fabric Tape Measure (HCAR0478)
- ☐ Pro 30-minute epoxy (GPMR6047)
- ☐ Pro 6-minute epoxy (GPMR6045)
- ☐ Robart Super Stand II (ROBP1402)
- ☐ Hobbico Builder's Protractor (HCAR0490)
- ☐ R/C foam rubber (1/4" [6mm] – HCAQ1000)



## PREPARE FOR ASSEMBLY



Before you begin assembling your airplane, take the time now to tack down the covering and get rid of any wrinkles. Areas like servo bays, stab/fin slots, or anywhere covering must be trimmed should be tacked down with medium/high heat before you trim them open. This prevents the covering from peeling up and will make it easier to cut clean, straight lines.



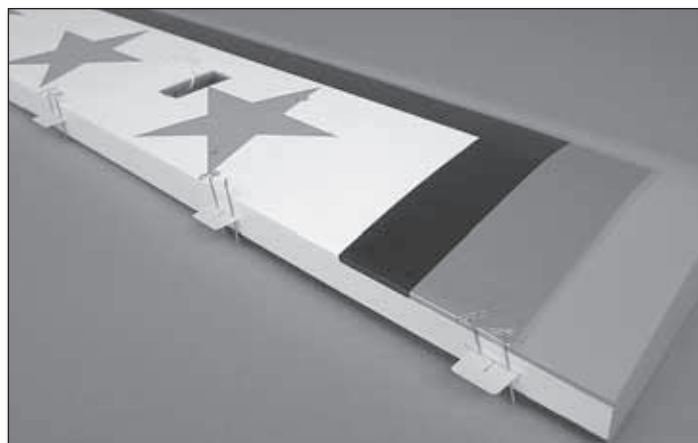
## WING CONSTRUCTION

### HINGE THE AILERONS

**Note:** For the following steps the upper left wing is shown.

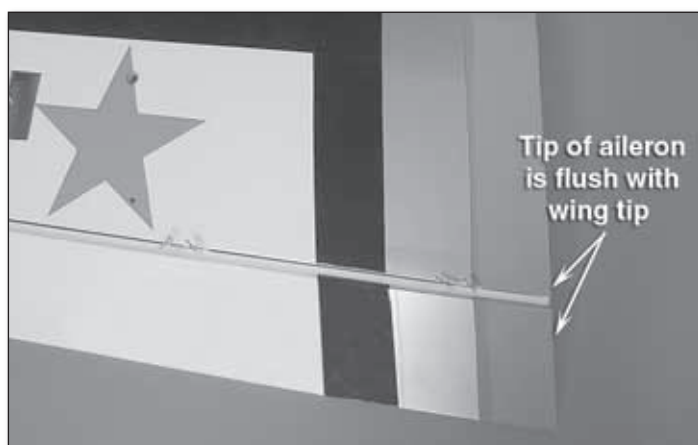


❑ 1. Use the back edge of a hobby knife to “dig out” each of the hinge slots on both of the wings and each of the four ailerons.

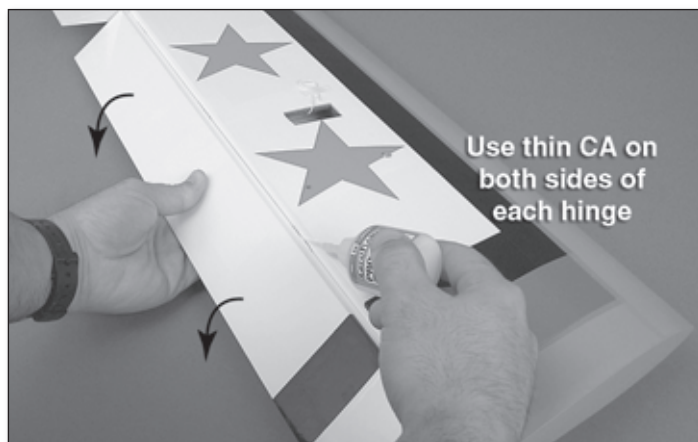


❑ 2. Prepare sixteen (16) CA hinges by placing a T-pin through the center of each hinge. Slide the hinges into the hinge slots of each wing.

❑ 3. Fit the ailerons to each wing. **Note:** All ailerons are identical with respect to shape and hinge slot location, but you must be careful to mount left side ailerons to the left wings and right side ailerons to the right wings because of differences in the trim scheme.



❑ 4. Working with one aileron at a time, slide the edge of each aileron all the way outboard on the wing so that the tip of the aileron is flush with the tip of the wing.

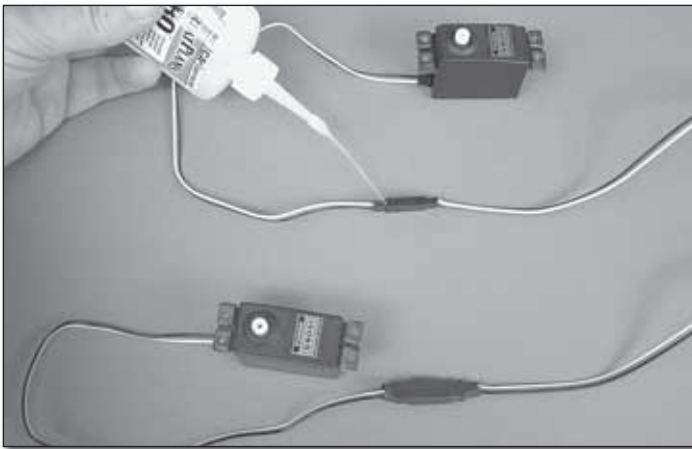


❑ 5. Push the aileron tightly up against the TE of the wing. Flex the aileron up and down a couple of times as you push in. Now remove the T-pins.

❑ 6. Hold the aileron in its full deflected position as you're pushing in and apply 10 to 12 drops of thin CA to each hinge. Turn the wing over and apply CA to the opposite side of the hinges.

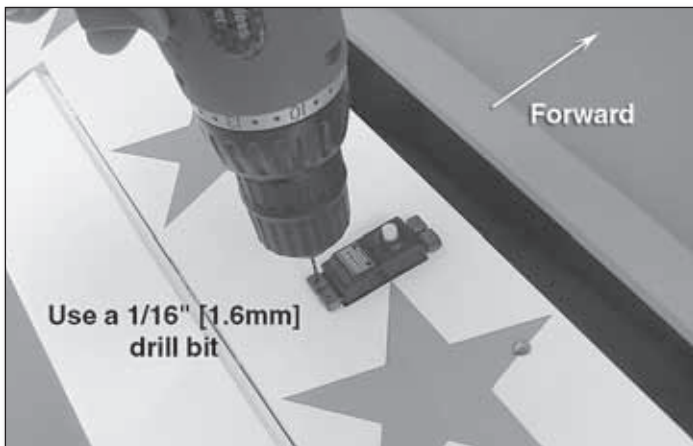
❑ 7. Repeat steps 4 through 6 for the other ailerons.

### SERVO & CONTROL HORN INSTALLATION

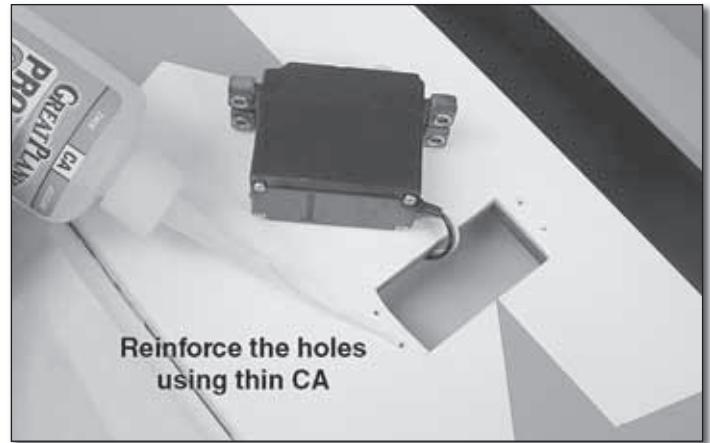


❑ 1. Gather four (4) servos and four (4) 12" [305mm] servo extension leads. Attach a lead to each servo. To secure the leads, use a piece of heat shrink tubing over the connection OR place a drop of medium CA along the seam of the connection.

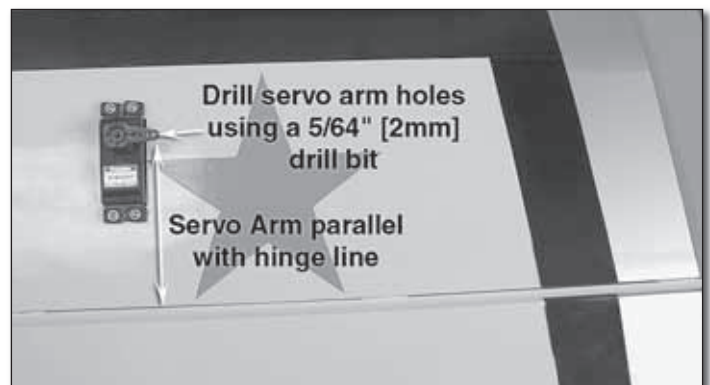
❑ 2. Tie a guide string to the end of each servo lead and carefully pull the lead through the wing. You may have to move the lead back and forth in the wing in order to clear each rib, so be careful. Save your guide strings for the elevator servo installation.



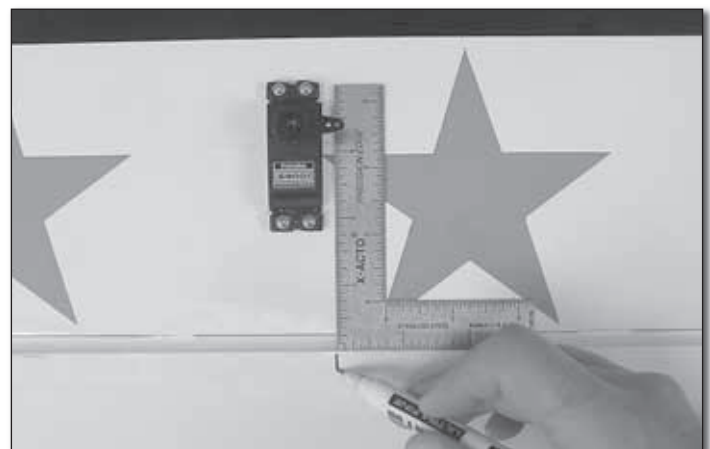
❑ 3. Position the servos in the servo bays with the output shaft facing forward. Using a 1/16" [1.6mm] drill bit, drill the holes for the servo mounting screws.



❑ 4. Use the screws that came with your servos to tap the holes. Remove the screws and place a drop of thin CA into each hole. This will harden the wood and will keep the screws from loosening over time.



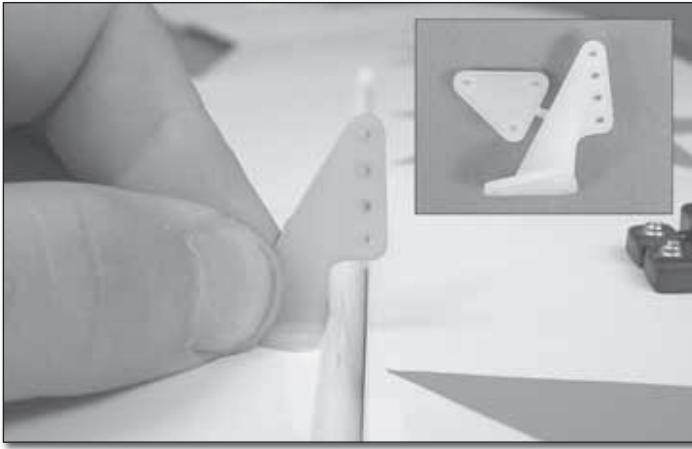
❑ 5. Use your radio to center your servos and install servo arms on each servo so that the arm that faces outboard is 90 degrees to the servo case and is parallel with the hinge line. Drill the holes with a 5/64" [2mm] drill bit. Cut off the remaining arms.



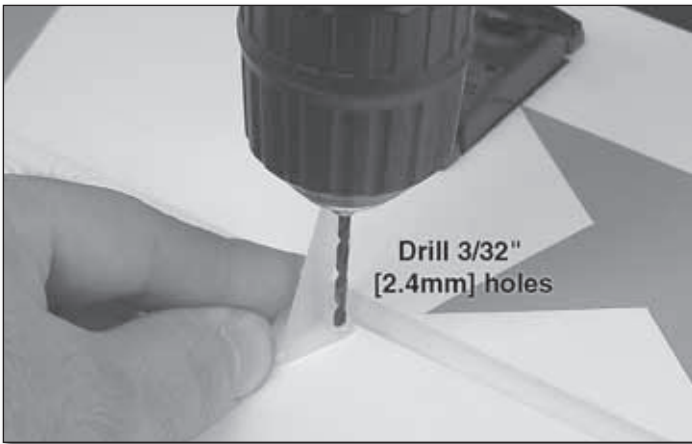
❑ 6. Use a straightedge or a builder's square to mark the position of the control horn centerline directly behind the third hole out from the center of the servo. Do this for each aileron.

❑ 7. Locate four (4) control horns, four (4) backplates and twelve (12) 2-56 x 1" [25mm] machine screws. Have your drill ready with a 3/32" [2.4mm] drill bit.

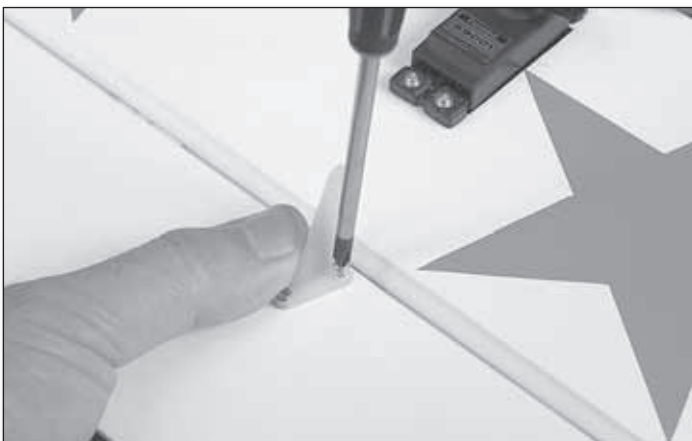




□ □ 8. Center a control horn on the line that you made. Now slide the horn forward or back until the pushrod holes are aligned directly above the hinge line.

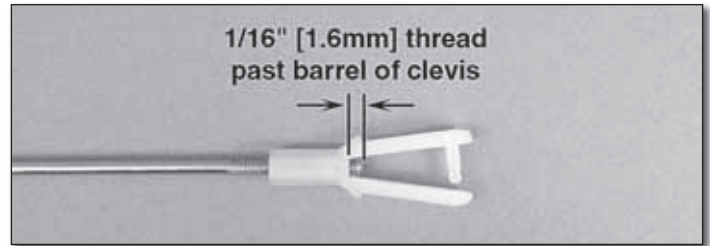


□ □ 9. Use the holes in the base of the **control horn** as a drilling template. Use a 3/32" [2.4mm] drill bit and drill three holes in the aileron. Use thin CA to harden the holes that you drilled. **Note:** Do not use the backing plate as a template. Its holes must not be drilled.



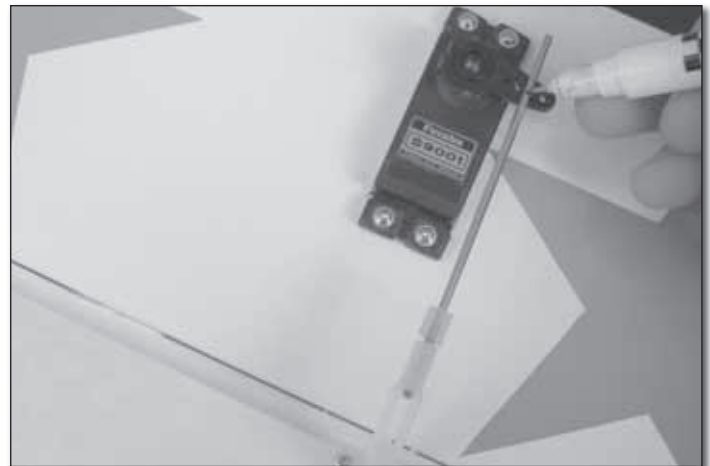
□ □ 10. Install the control horn and its plastic backplate with three 2-56 x 1" [25mm] machine screws. Cut off the excess portion of the screw when you're done.

□ □ 11. Repeat steps 7 through 10 for each aileron.

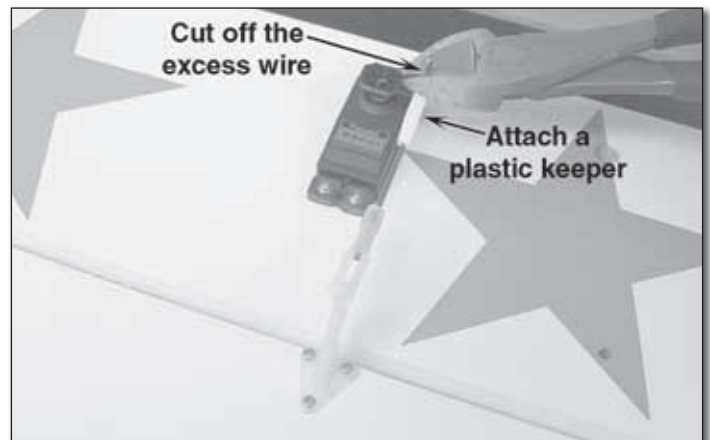


□ □ 12. Locate the four (4) 3-1/4" [83mm] long aileron pushrods and four (4) plastic clevises. Thread the clevises onto the pushrods so that 1/16" [1.6mm] of thread is exposed on the inside of the threaded barrel of the clevis. Slide a silicone clevis retainer onto the pushrod.

□ □ 13. Attach the clevis to the outermost hole of the control horn.



□ □ 14. Holding the aileron in the neutral position, extend the pushrod to the third hole out from the center of the servo arm. Mark the pushrod at the hole. Make a 90° bend at the mark.

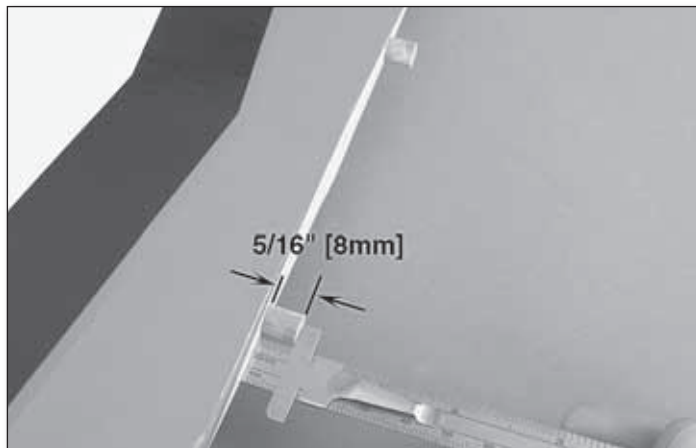


□ □ 15. Install the pushrod in the third hole out from the center of the servo arm. Attach a plastic keeper to the pushrod and cut off the excess portion of the pushrod when you're done.

□ □ 16. Repeat steps 12 through 15 for the remaining ailerons.

## WING DOWEL INSTALLATION

- ❑ 1. Locate the two 5/16" x 2" [8 x 51mm] wing dowels. Test fit each dowel in the LE of the pre-drilled holes of the lower wing. To help installation in the fuselage later, you may round the tip of each dowel using sandpaper.



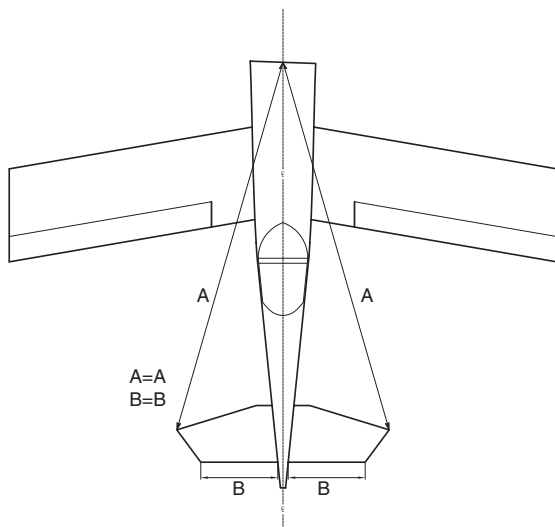
- ❑ 2. Glue the dowels in the wing with epoxy. Install them so that the top of the dowels are 5/16" [8mm] from the LE of the wing. **Note:** If the dowels are longer than this, they will not allow the lower wing to seat properly.



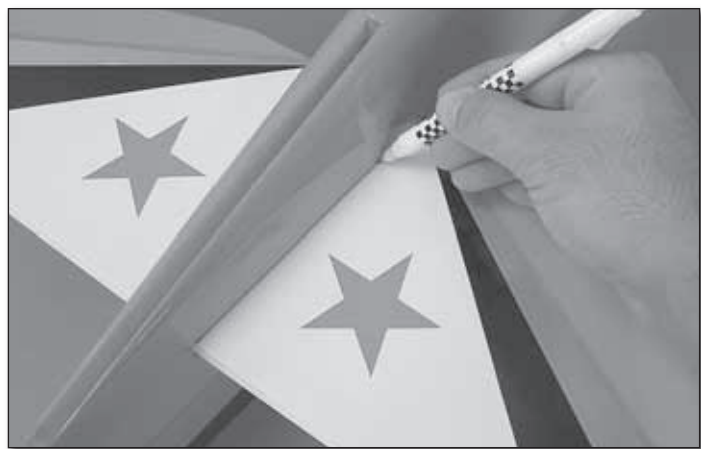
## FUSELAGE CONSTRUCTION

### STABILIZER & FIN INSTALLATION

- ❑ 1. Temporarily fit the bottom wing.
- ❑ 2. Trim the covering from the horizontal stabilizer slots in the fuselage.



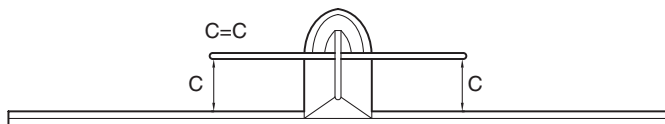
- ❑ 3. Slide the stab into the fuselage. Center the TE of the stab so that the distance A=A. Make a mark at the top center of the firewall and measure the distance from each stab tip. The stab is correctly aligned when the distance A=A and B=B.



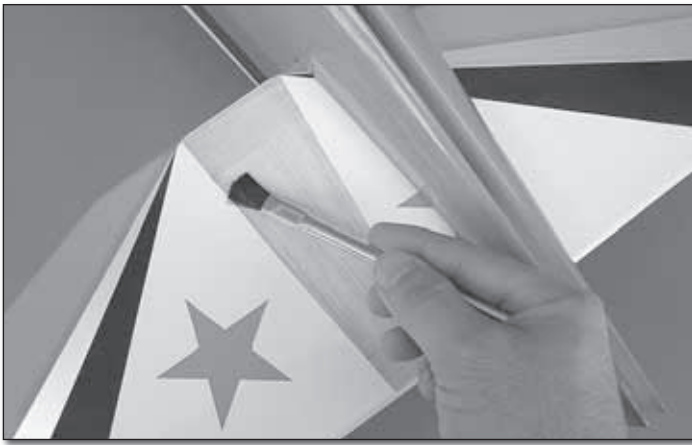
- ❑ 4. Use a fine felt-tip pen to draw lines on the stab where the stab meets the fuselage. Don't forget to draw lines on both the top and bottom of the stab.



- ❑ 5. Lay a straightedge just a bit inboard of each line you drew. Trim the covering along the edge of the straightedge. Be very careful not to cut into the wood fibers – a fresh hobby knife blade should allow you to cut the covering when light pressure is applied.

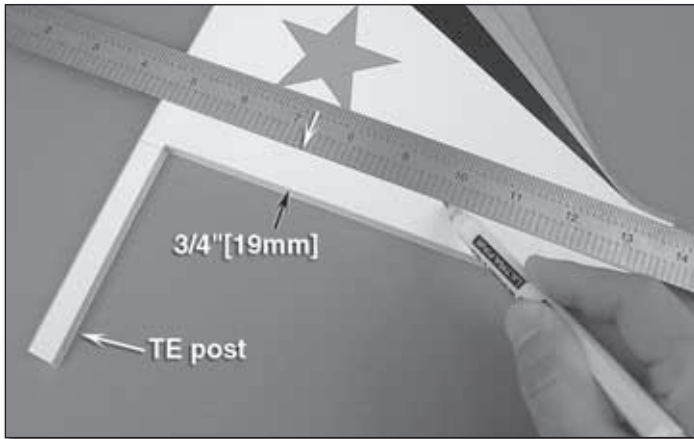


- ❑ 6. Slide the stab back into the fuselage and center it as you did earlier. Level the stab so that it is parallel with the wings. You may lightly sand the slots in the fuselage to adjust the stab, but be careful not to make the slot too loose.



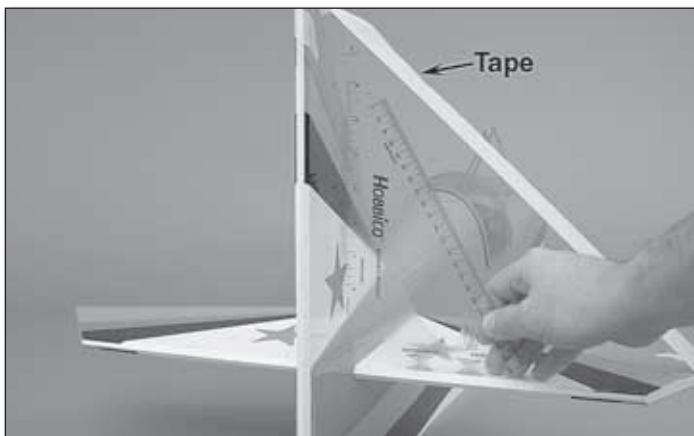
❑ 7. Coat the top and bottom of the stab with 30-minute epoxy. Fit and align the stab as you did earlier, but take note of the trim design – the top and bottom are very similar, so be careful to install it with the right side up.

❑ 8. Use denatured alcohol applied to a paper towel to clean up the excess epoxy. Set the fuselage aside until the epoxy cures.



❑ 9. Lay the vertical fin on your building table. Draw a line that is 3/4" [19mm] above the bottom edge of the fin and is parallel to that edge.

❑ 10. Trim the covering from the fin at the line you drew. Don't forget to trim the covering from the vertical TE post.



❑ 11. Apply 30-minute epoxy to the fin and glue it into the fuselage. Use a builder's square to make sure that the fin

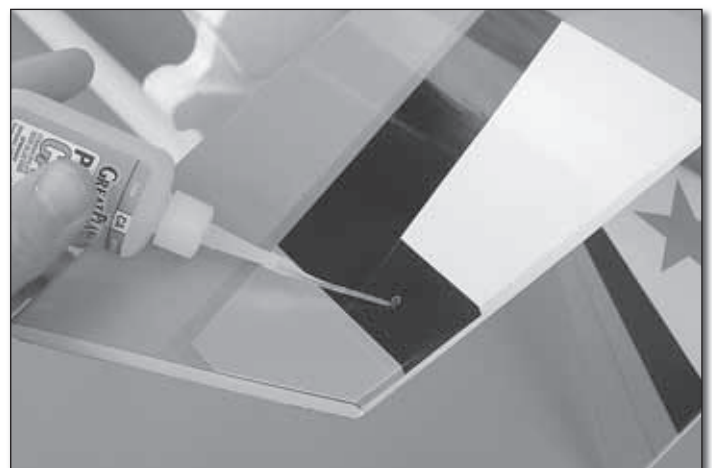
is perpendicular to the stab. You can hold it in position with masking tape.

❑ 12. As you're waiting for the epoxy to cure, you can jump ahead and build up your landing gear.

### FLYING WIRES INSTALLATION

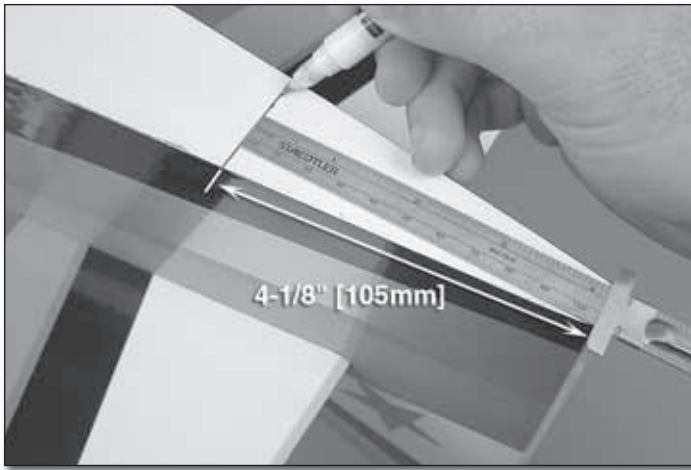


❑ 1. Gather two (2) 7-3/4" [197mm] flying wires, two 8" [203mm] flying wires, and four (4) 9-3/4" [247mm] flying wires. These should have a plastic fitting at each end.

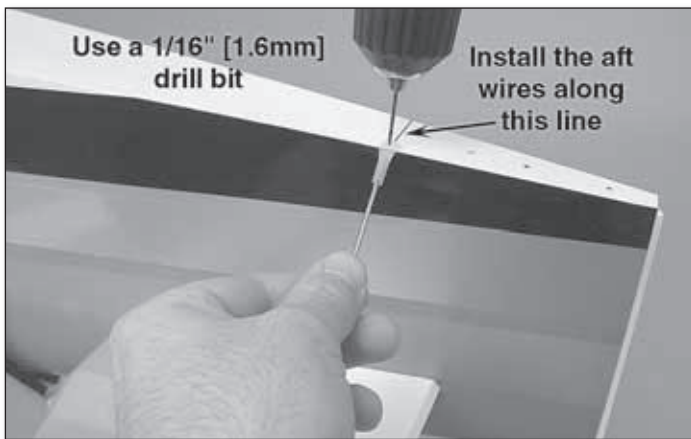


❑ 2. Harden each of the pre-drilled holes in the fin and the stab with thin CA.

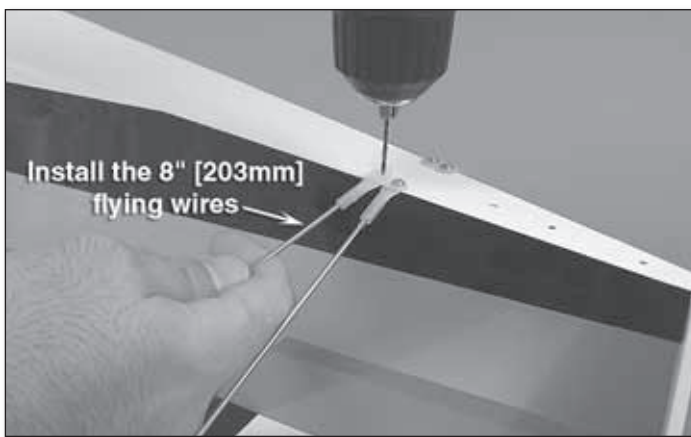
❑ 3. Turn the fuselage over. A foam fuselage cradle is very helpful here.



- ❑ 4. Measure 4-1/8" [105mm] forward from the TE of the fuselage (the rudder hinge line) and draw a line straight across the bottom of the fuselage.



- ❑ 5. Use one of the small 10mm wood screws to attach each of the two bottom aft flying wires (7-3/4" [197mm] wires) to the bottom of the fuselage. Attach them at the line you drew. Drill a 1/16" [1.6mm] pilot hole to help you start the screw and use thin CA to harden each hole. The other end of each wire will attach to the aft hole in the stabilizer.



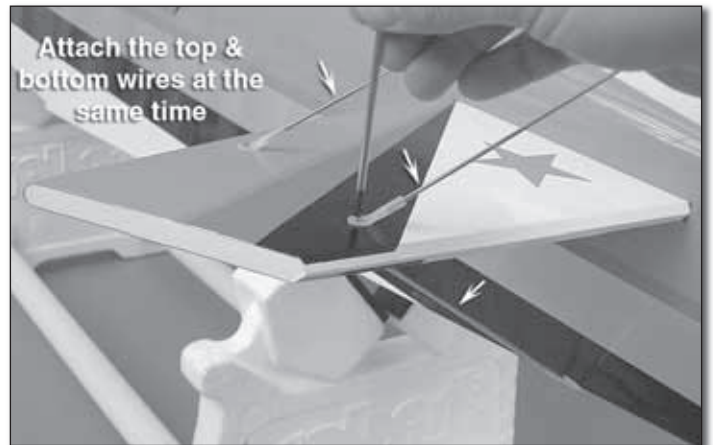
- ❑ 6. Using the same method, install the two 8" [203mm] flying wires just ahead of the ones you just put in.

- ❑ 7. Adjust the length of the bottom wires until they match the holes in the stab. Be careful to allow an equal amount of thread engagement on each fitting. **Note:** You don't

necessarily want these to be equal lengths on both sides – just make sure that the stab and fin are both aligned.



- ❑ 8. Flip the fuselage over and use two (2) 2-56 x 5/8" [16mm] machine screws and two (2) #2 nuts to loosely attach the four (4) 9-3/4" [247mm] upper flying wires to the vertical fin. One screw will hold both the left and right wires.



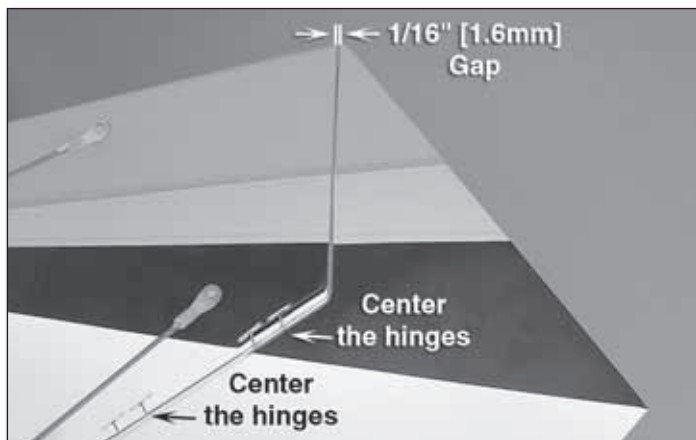
- ❑ 9. Use two (2) 2-56 x 5/8" [16mm] machine screws and #2 nuts to attach the other ends of the flying wires to the left stabilizer. The corresponding top and bottom wires are attached with one screw and a nut. Repeat this for the right stabilizer. Apply one drop of threadlocking compound to each of the six screws.



## HINGE THE TAIL CONTROL SURFACES

❑ 1. Prepare six (6) hinges and slide them into the horizontal stabilizer.

❑ 2. Being mindful of the trim scheme, fit the left elevator to the left stab and the right elevator to the right stab.



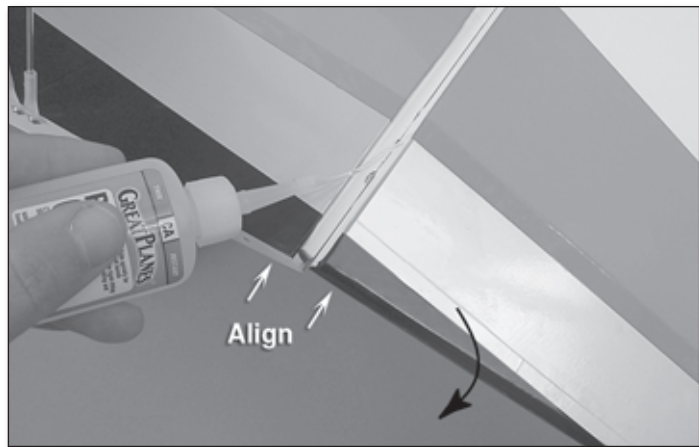
❑ 3. Align each elevator so that there is a 1/16" [1.6mm] gap between the elevator counterbalance and the tip of the stab.



❑ 4. Remove the T-pins from the hinges and push the elevators up against the stab. Fully deflect each elevator and apply 10 to 12 drops of thin CA to the top and bottom of each hinge.

❑ 5. Prepare three (3) hinges and fit them to the vertical fin. Fit the rudder to the hinges.

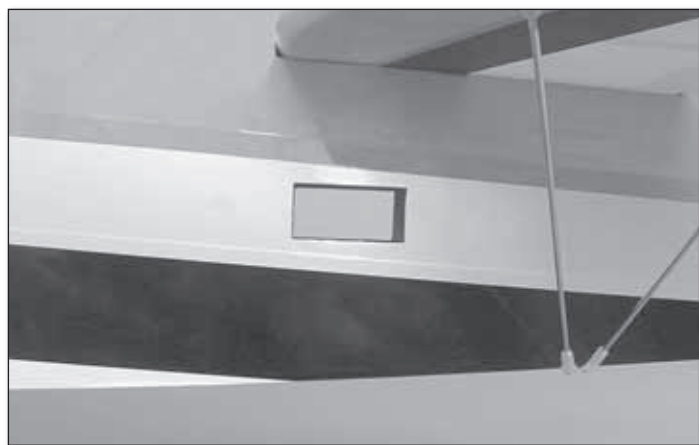
❑ 6. Align the bottom of the rudder with the bottom of the fuselage.



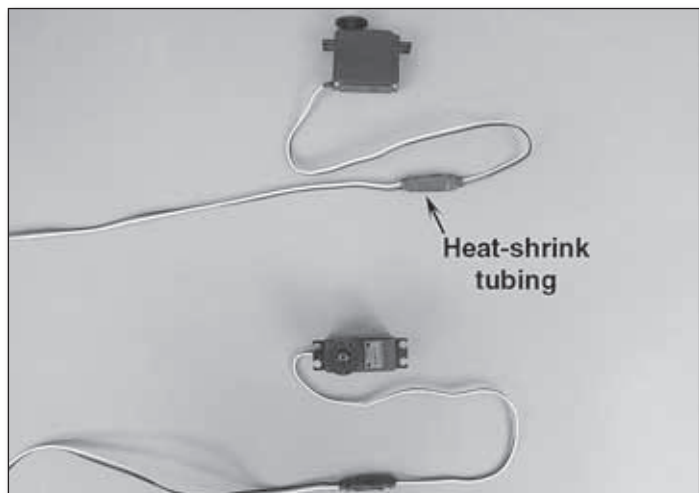
❑ 7. Remove the T-pins and deflect the rudder. Apply 10 to 12 drops of thin CA to both sides of each hinge.

❑ 8. Allow all of the hinges to air-dry. Do not use CA accelerator. You may use CA debonder applied to a paper towel to clean up any CA fogging or stray drops of CA on the covering.

## ELEVATOR SERVO & CONTROL INSTALLATION



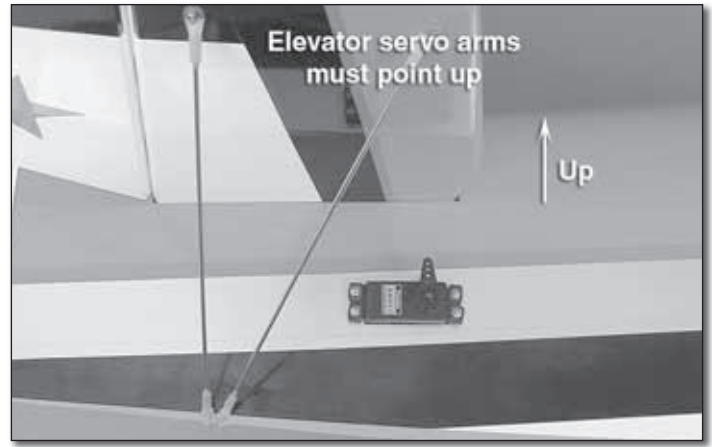
❑ 1. Trim the covering from the servo bay holes in the fuselage sides.



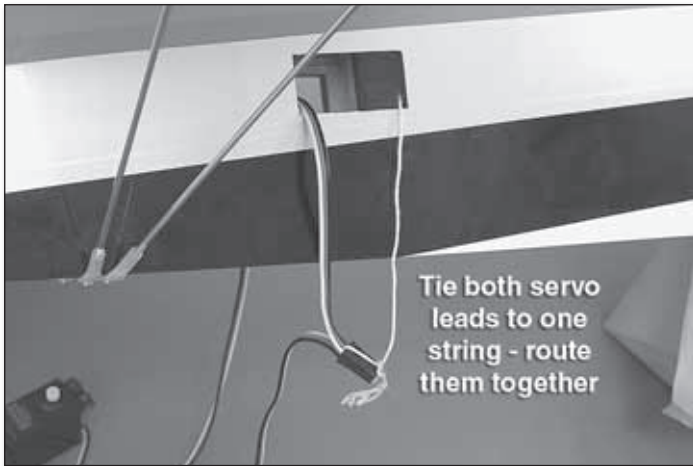
❑ 2. Install a 24" [610mm] servo extension onto each of the elevator servos. Use heat shrink tubing to secure the connections.



❑ 3. Use the servo lead strings that you used previously for the aileron installation to help you route your elevator servo leads. Tie a spare nut or a servo wheel to the end of the string.



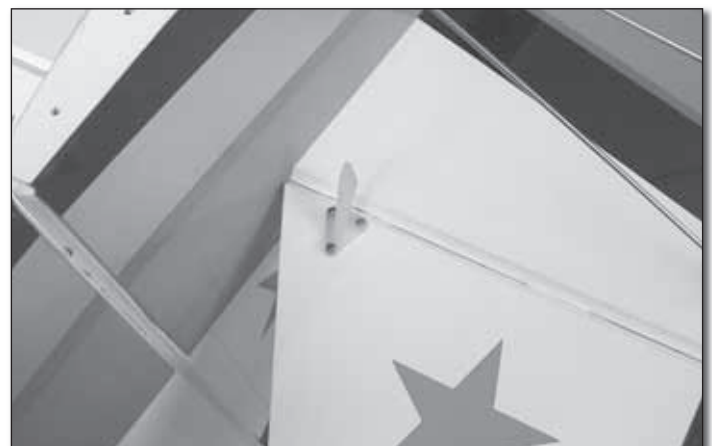
❑ 6. Center your servos and install a long servo arm onto each elevator servo. Choose the arm that points up and is 90 degrees to the servo case. Cut off the unused arms.



❑ 7. Using a straightedge, project a line from the servo arm to the elevator. Make a mark on the elevator for the control horn. Do this for both elevators.



❑ 4. Route the string into the fuselage through each elevator servo bay and route it up and over the two formers in the fuselage. This will prevent your elevator servo leads from rubbing on or becoming tangled with the rudder pull-pull system.



❑ 8. Install the elevator control horns using six (6) 2-56 x 1" [25mm] machine screws. Use a 5/64" [2mm] drill bit to drill the holes.

❑ 5. Install the elevator servos with the output shafts facing forward. Use the screws that came with your servos.

❑ 9. Locate two (2) 6" [152mm] pushrods and two (2) plastic clevises. Thread the clevises onto the pushrods so that 1/16" [1.6mm] of thread is exposed on the inside of the threaded barrel of the clevis. Slide a silicone clevis retainer onto the pushrods.

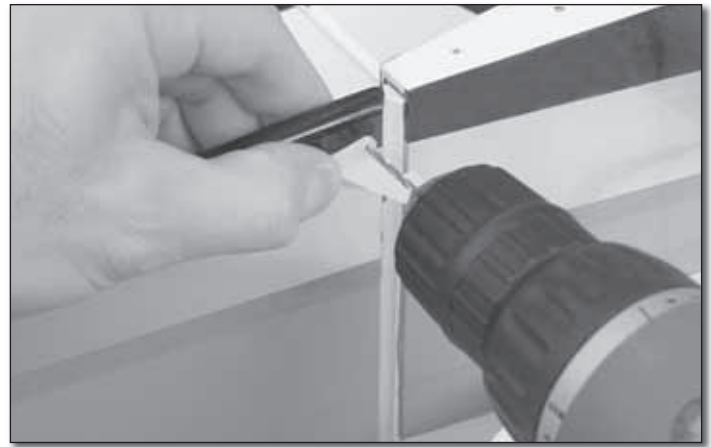
❑ 10. Attach each pushrod to the outermost hole of the elevator control horns.

❑ 11. Tape or hold the elevator in the neutral position. Extend the pushrod to the third hole out from the center of the servo arm. Make a 90° bend at the mark.



❑ 12. Attach a plastic keeper to the pushrod and cut off the excess portion of the pushrod.

❑ 13. Repeat steps 11 and 12 for the other elevator.



❑ 3. Make a mark 5/8" [16mm] from the bottom of the rudder. Center a control horn over the mark and drill three holes.



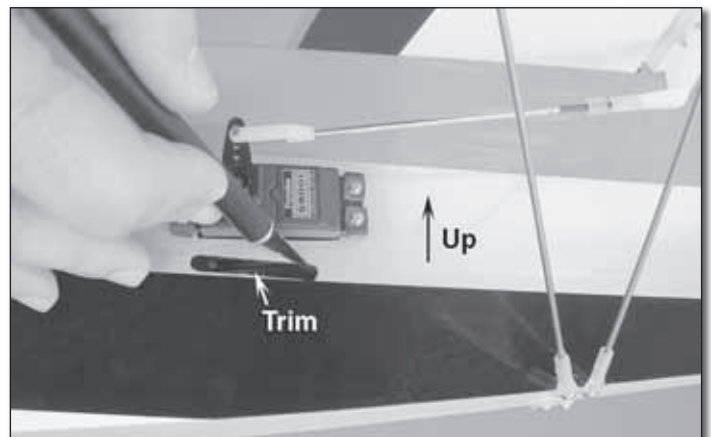
❑ 4. Attach two control horns as shown using three (3) 2-56 x 1" [25mm] machine screws and three (3) #2 nuts. Use threadlocking compound on the screw threads.

## RUDDER SERVO & CONTROL INSTALLATION

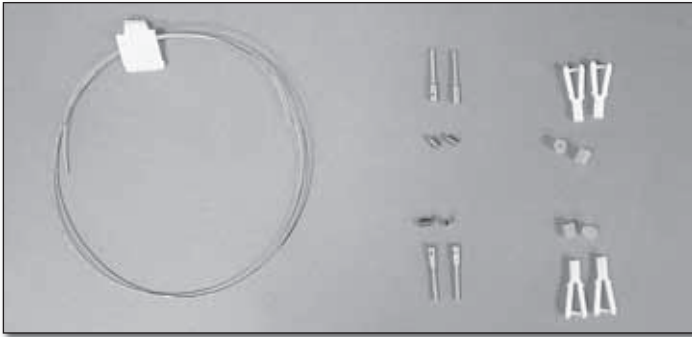


❑ 1. Install the rudder servo in the servo tray.

❑ 2. Center the servo and fit a long, double-sided servo arm to it.

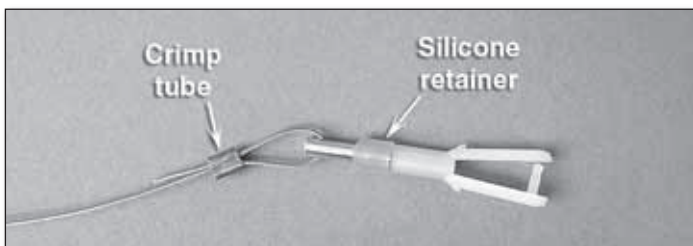


❑ 5. Trim away the covering from the rudder cable exit holes in the fuselage. These are located directly below the elevator servos.



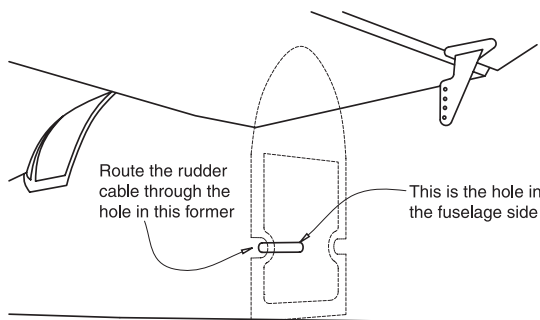
❑ 6. Locate two (2) 36" [915mm] control cables, four (4) threaded cable couplers, four (4) crimp tubes, and four (4) clevises.

❑ 7. Thread a clevis onto each of the four threaded cable couplers. Thread it on far enough so that the coupler threads are 1/16" [1.6mm] past the barrel of the clevis.



❑ 8. Prepare one end of each cable as shown. Fold at least 1" [25mm] of cable over and crimp it tightly using your pliers. **DO NOT** crimp the other end of the cable yet. You will need to custom fit it later.

❑ 9. Visually inspect the crimps that you just made. Check to see that the wires are firmly crimped in place. Inspect any further crimps that you must make in the same manner



❑ 10. Attach a control cable to the outboard hole of one rudder control horn and route it into the fuselage. There is a

former directly ahead of the cable exit holes. Be sure to route the cable through the hole in the former.

❑ 11. Visually inspect the cable routing. Make sure that your rudder cables will not interfere or become tangled in the elevator servo leads.

❑ 12. Tape a straightedge to the side of the fin and rudder to hold the rudder straight.

❑ 13. Center your rudder servo. **Note:** It may be helpful to leave your radio "ON" during the rigging procedure to ensure that the rudder servo will remain straight.



❑ 14. Extend the other end of the rudder cable into the fuselage. Assemble the cable couplers and adjust the length of the rudder cable as close as you can. Crimp the cable. Don't worry too much about getting the cable length perfect. You can still adjust the cables using the threaded clevises.

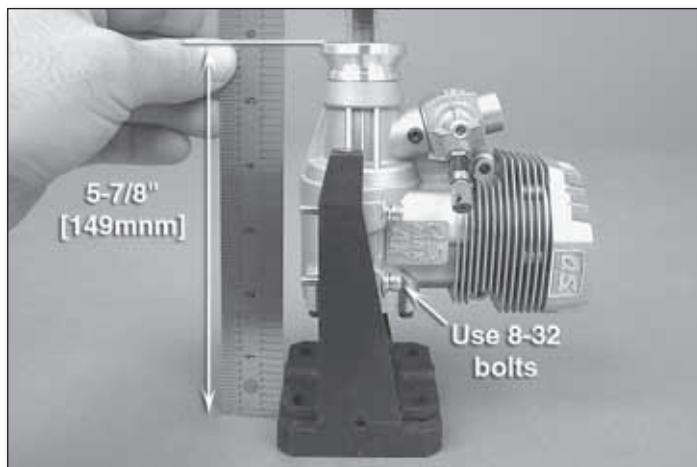
❑ 15. Repeat the last step for the other cable.



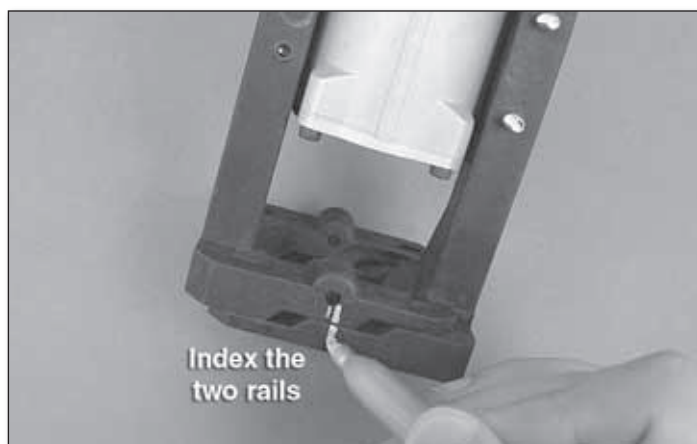


## ENGINE INSTALLATION

### FIT THE ENGINE



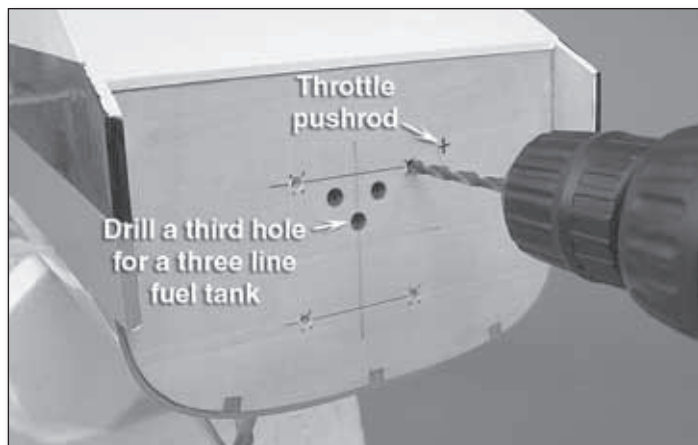
❑ 1. Fit the engine to your engine mount so that the drive washer of the engine is **5-7/8" [149mm]** from the base of the mount (firewall). Use a minimum of 8-32 bolts to attach the engine to the mount (these are not supplied with the kit). Drill and tap your mount.



❑ 2. Make index marks between the two sliding rails. This will help you note the position of the rails for the next step.

❑ 3. Remove the engine from the mount, keeping the two sides of the mount together.

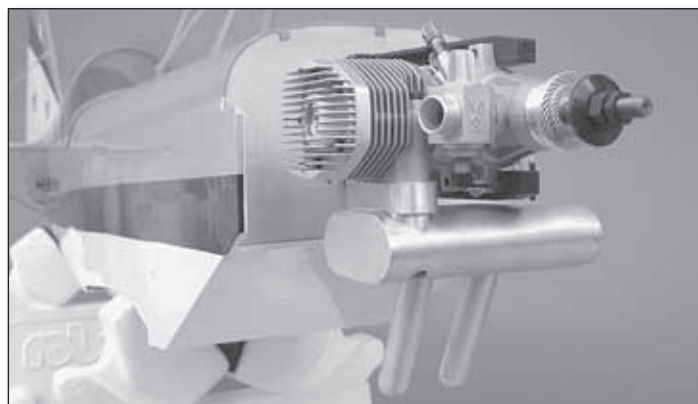
❑ 4. Center the engine mount over the cross-hairs etched into the firewall. Be careful to note the position of the mount so that the cylinder head is oriented on the proper side of the fuselage. Mark the location for the engine mount bolts and where you will need to drill the hole for the throttle pushrod.



❑ 5. Drill four 7/32" [5.6mm] holes for the engine mount bolts. Drill a 5/32" [4mm] hole for the throttle pushrod while you're at it. If you're going to use a three line fuel tank setup, go ahead and drill a third hole now. Use a 7/32" [5.6mm] drill bit for this.

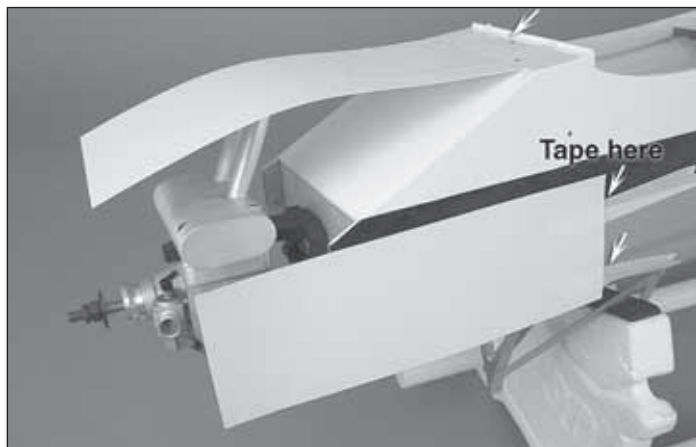


❑ 6. Locate the four (4) 8-32 x 1" [25mm] engine mount bolts and their associated 8-32 blind nuts. Press the blind nuts into the back side of the firewall. You can use the bolts to help you pull the blind nuts into position.



❑ 7. Bolt the engine and the engine mount to the firewall. Temporarily attach the muffler.

## TRIM THE COWL



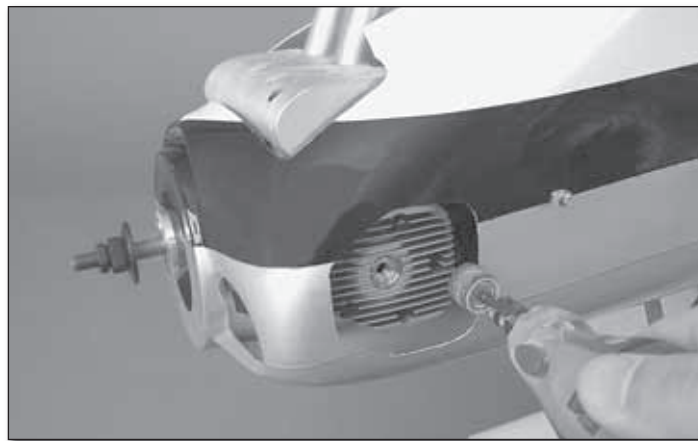
- ❑ 1. Tape a 4" x 13" [102 x 330mm] piece of card stock to the fuselage so that it lays over the cylinder head. Tape a 6" x 11" [152 x 280mm] piece of card stock to the fuselage bottom so that it is positioned over the muffler. You may also need to make a template for your mixture control valves.



- ❑ 2. Trim a hole in the card stock to accommodate your engine's cylinder head, muffler, and mixture control valves. Trim a little and then check your progress by laying the templates over the engine. When you're satisfied, leave the templates attached where they are. You'll be fitting the cowl next, so the engine will be removed. The templates will help you transfer your engine's exact location to the outside of the cowl.

- ❑ 3. Remove the engine and engine mount and set them aside. If your engine does not interfere with the cowl, you may leave it attached. We left the engine attached and removed the muffler.

- ❑ 4. Use the six (6) 1/2" [13mm] button head screws to attach the cowl.

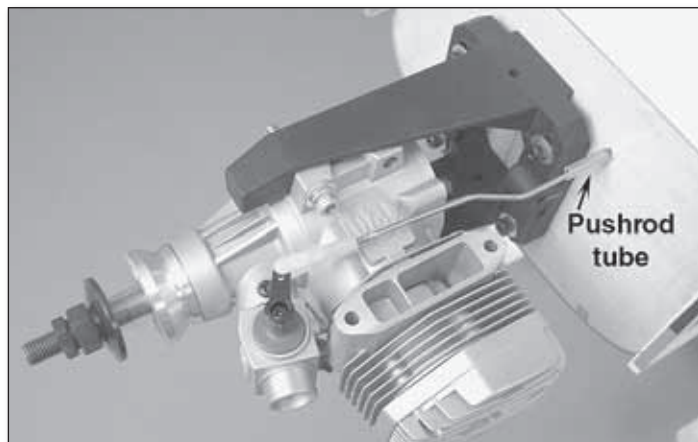


- ❑ 5. Trace around the openings in the templates you made. Use a Dremel tool to cut a hole in the cowl for the cylinder head, muffler, and needle valves. Fit the engine and muffler and re-trim where necessary.

- ❑ 6. Remove the cowl and set it aside.

## THROTTLE PUSHROD & SERVO INSTALLATION

- ❑ 1. Install your engine and engine mount using threadlocking compound with the four (4) 8-32 x 1" [25mm] engine mount bolts and four (4) #8 washers.
- ❑ 2. Locate the 20" [508mm] throttle pushrod, the throttle pushrod tube, one threaded clevis, and one silicone clevis retainer. Thread the clevis on so that at least 1/16" [1.6mm] is threaded past the inside end of the barrel of the clevis.



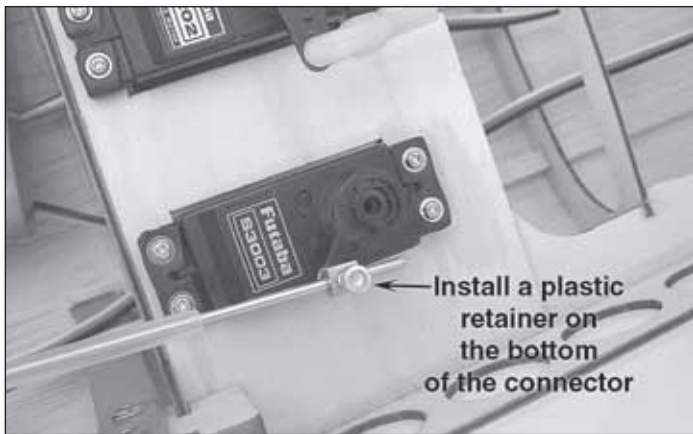
- ❑ 3. Fit the pushrod tube into the hole that you drilled earlier and slide the pushrod into the tube. Attach the clevis to the throttle arm. Bend the pushrod around any obstructions.



## RADIO INSTALLATION

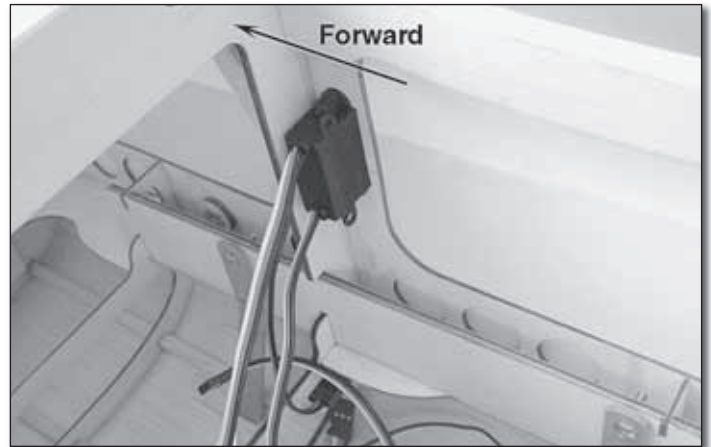


- ❑ 4. Install the throttle servo.

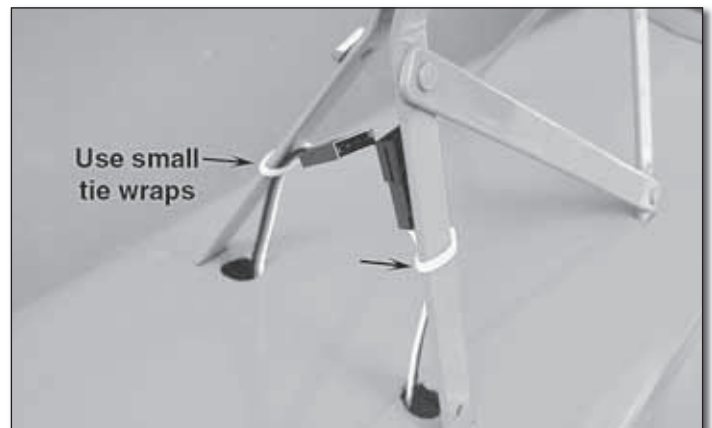


- ❑ 5. Prepare a servo arm or a servo wheel and install a screw-lock pushrod connector. Use a plastic retainer to secure the connector to the servo arm.

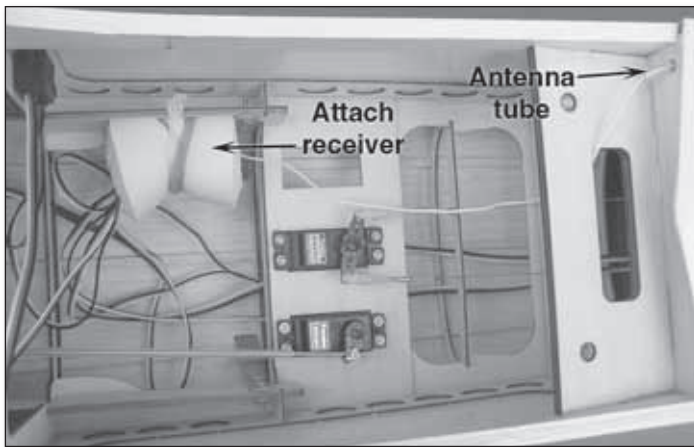
- ❑ 6. Fit the muffler and any extension that you may need for the main mixture control valve.



- ❑ 1. Install a new radio switch in the right side of the fuselage. There is a cutout for a switch there. Optionally you can install a switch and charge jack, but you will need to mount it up higher along the same former. You can also mount it to the opposite side. The Great Planes Switch and Charge Jack Mounting Set (GPMM1000) is a good choice because of its thin profile.



- ❑ 2. Install a heavy duty Y-harness to the upper cabane struts using small tie wraps to secure each lead of the harness to the cabane struts. **Note:** We chose a heavy duty harness for this application because of the long leads.



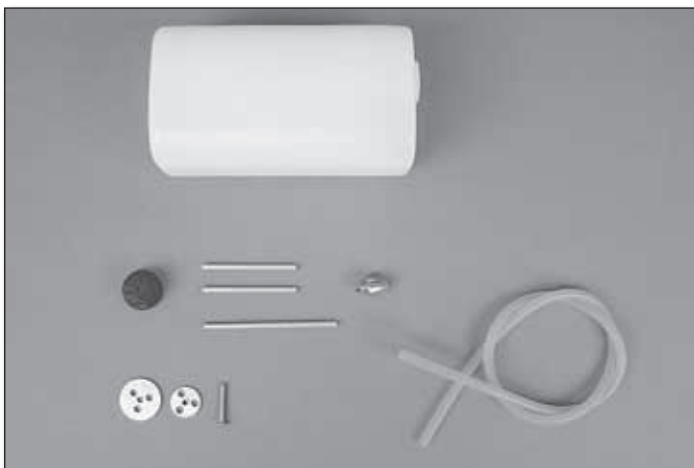
❑ 3. Connect your servo leads and the battery switch lead to the receiver. Connect a Y-harness to your aileron channel. Wrap the receiver in latex foam rubber and install it in the fuselage.

❑ 4. Route the receiver's antenna lead through the antenna tube as shown. Make sure that your antenna is fully extended.



## FUEL TANK & BATTERY INSTALLATION

### FUEL TANK ASSEMBLY



❑ 1. Gather the parts required for the fuel tank. You will need: one (1) plastic fuel tank, one (1) rubber stopper, one (1) stopper washer, one (1) stopper nut, one (1) stopper screw, three (3) aluminum fuel lines, and one clunk. If you are going to use a three line tank, you will need to purchase a third fuel clunk and some extra fuel tubing.

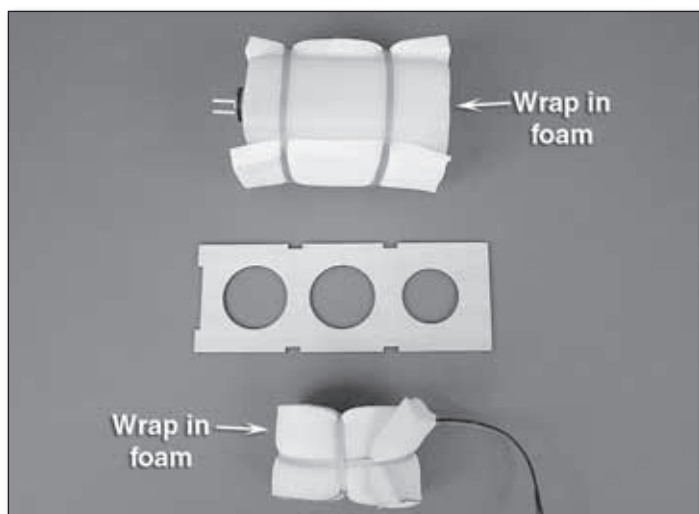


❑ 2. Assemble the stopper as shown with the vent line pointing up to the top of the tank. The top of the tank must be one of the wide sides so that the tank lays down as flat to the tray as possible. Make sure that the clunk is spaced at least 1/4" [6mm] from the back of the fuel tank – this will prevent it from hanging up when the airplane flies inverted. **Note:** We elected to use the three line setup, so there are two clunks (only one is supplied with this kit).

❑ 3. Label your vent, fill, and carb lines coming out of the tank and install the stopper onto the tank. Do not overtighten the stopper: this can cause the tank to split. Draw an arrow on the back of the tank so you can easily tell which side is up (vent).

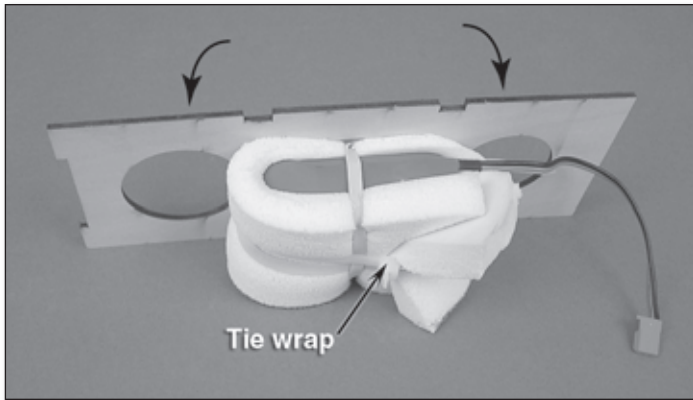
### MOUNT THE FUEL TANK & BATTERY

You may want to wait until your model is ready to balance to perform this section. The 1.20 two-stroke that we installed in this manual required a few ounces of ballast weight to arrive at the proper C.G. with the battery installed on the fuel tank tray as shown in the next steps. Installing a 1.20 four-stroke without using lead ballast required the battery to be moved to the bay just behind the fuel tank.

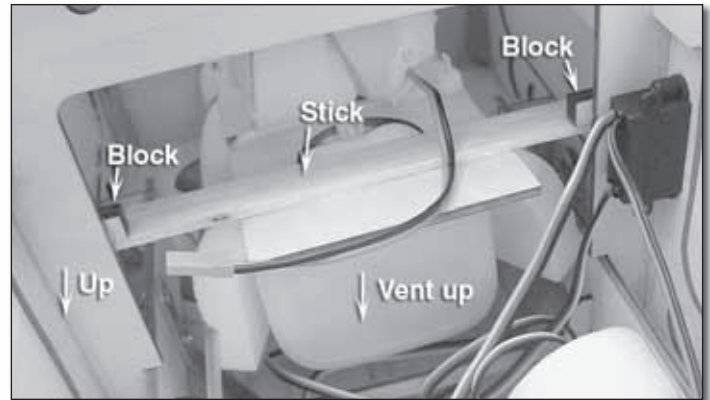


❑ 1. Wrap your fuel tank and radio battery in latex foam rubber. Use a minimum of 1/4" [6mm] thick foam. Locate the fuel tank tray.

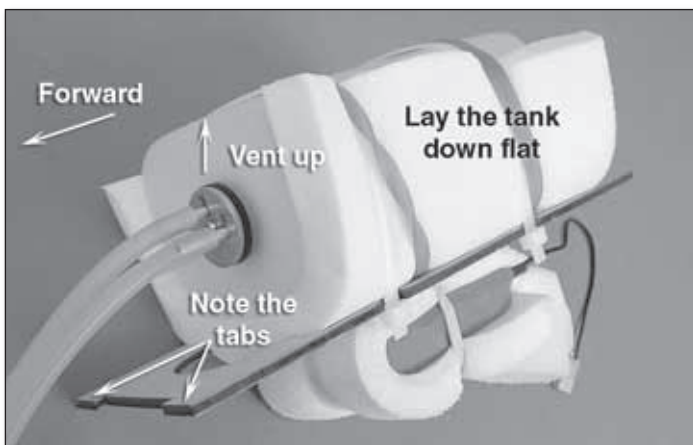




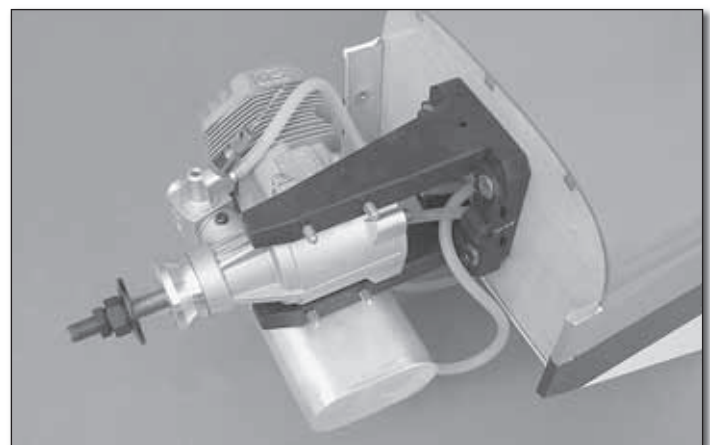
❑ 2. Use one large tie wrap to attach your battery to the fuel tank tray. **Note:** You may need to drill a few holes in the tray in order to mount your battery securely.



❑ 6. Use the 6" [152mm] stick to support the fuel tank. Push the tank tray forward until it is locked into the firewall cutouts. Epoxy the stick to the former and the tray. Use the supplied blocks to increase the gluing area on the former.



❑ 3. Use two large plastic tie wraps to secure your tank and battery to the fuel tank tray. **Note: The two tabs face forward.** Make sure you install the vent side of the tank up (away from the tray).



❑ 7. Attach your fuel lines.

❑ 4. Install silicone fuel lines to the tank.



❑ 8. Connect the battery to the radio switch. Use heat shrink tubing to ensure that the battery will not become disconnected.

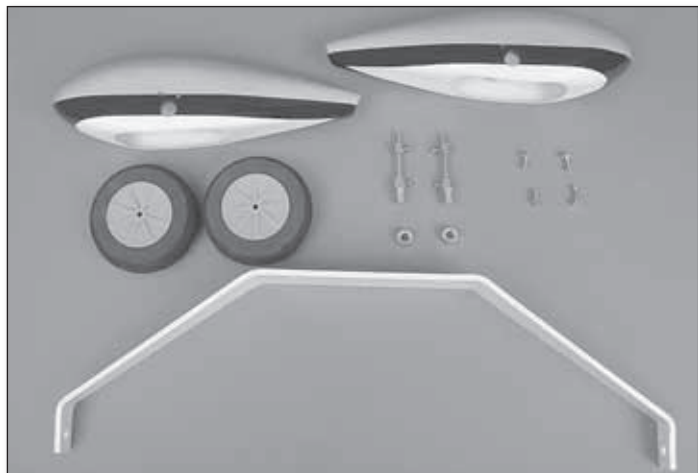


❑ 5. Fit the tank and tray assembly into the fuselage. The fuel tank tray tabs fit into the semi-circular cutouts on the back side of the firewall. Make sure that the tank points up and that the fuel lines are routed through the firewall without any kinks.



## LANDING GEAR INSTALLATION

### MAIN LANDING GEAR INSTALLATION



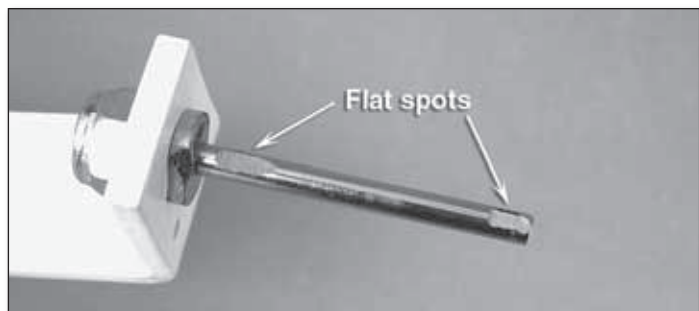
- ❑ 1. Collect the following parts: One (1) landing gear strap, two (2) wheel pants, two (2) 3-1/4" [83mm] axles, two (2) self-locking axle nuts, four (4) wheel collars, four (4) 4-40 x 1/2" [13mm] screws, and four (4) 4-40 blind nuts.



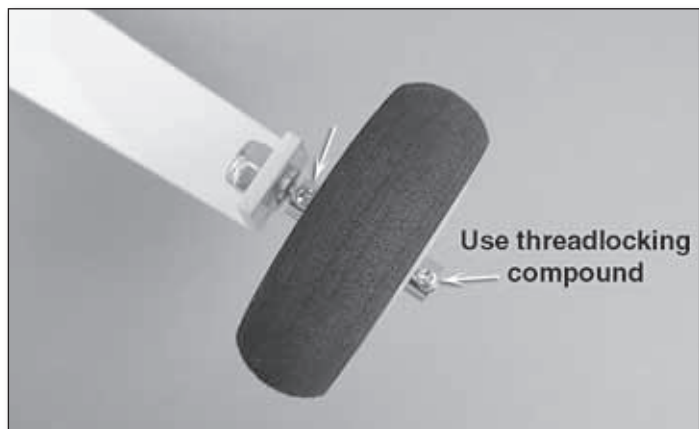
- ❑ 2. Install the axles onto the landing gear strap using the self-locking axle nuts.



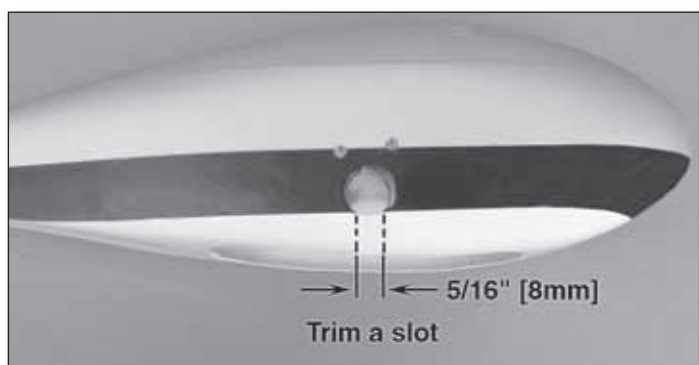
- ❑ 3. Position a wheel collar on each axle so that there is a 1/16" [2mm] gap between the wheel collar and the base of the axle. Fit the wheel and the outer wheel collar.



- ❑ 4. Remove the wheel collars and file flat spots on the bottom side of each axle.



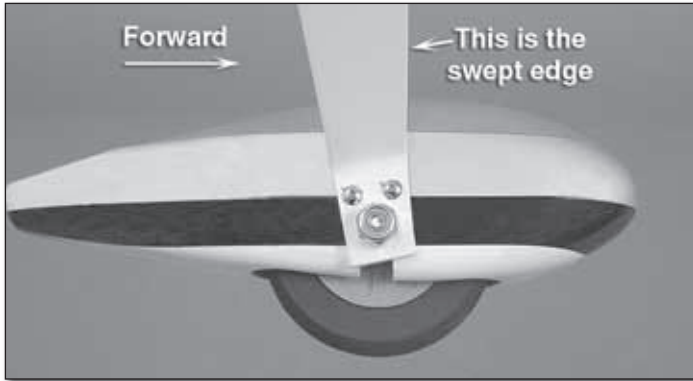
- ❑ 5. Install each wheel using an inner and an outer wheel collar. Apply threadlocking compound to the threads of each wheel collar's locking screw. **Note:** The shouldered portion of each wheel collar should face the wheel.



- ❑ 6. Cut a 5/16" [8mm] wide slot in each of the wheel pants in the location shown.



- ❑ 7. Install two 4-40 blind nuts in each wheel pant from the inside.



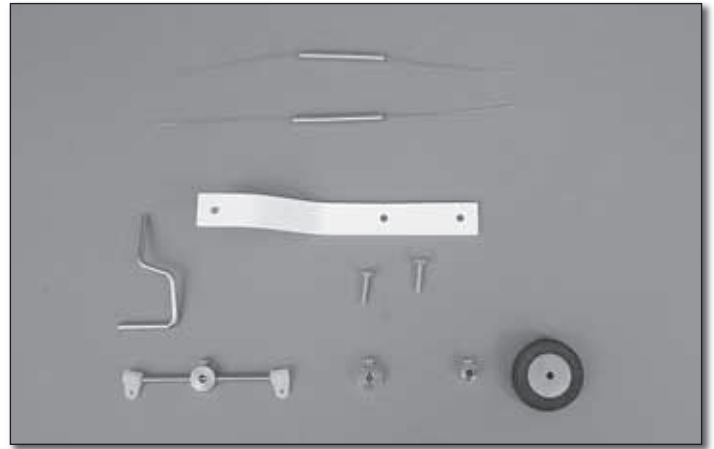
- ❑ 8. Install each wheel pant using the four (4) 4-40 x 1/2" [13mm] screws and some threadlocking compound. Note the direction of the landing gear strap – the swept edge of the gear faces forward.



- ❑ 9. Use three (3) 8-32 x 3/4" [19mm] bolts and three #8 washers to attach the landing gear to the fuselage. Use threadlocking compound on the bolt threads.

- ❑ 10. Apply a couple drops of light machine oil to the axles and check them for free rotation.

## TAIL WHEEL INSTALLATION & RIGGING



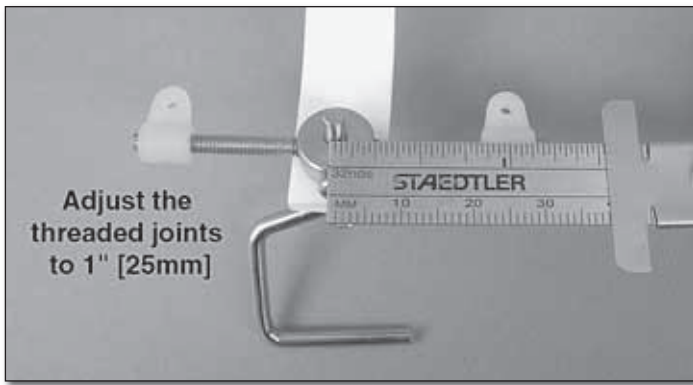
- ❑ 1. Collect the following parts: One (1) tail wheel landing gear strap, one (1) tail wheel wire, one (1) 1-1/4" [32mm] tail wheel, one (1) steering arm assembly, one (1) large area wheel collar, one (1) standard collar, two (2) springs, and two (2) 4-40 x 1/2" [13mm] screws.



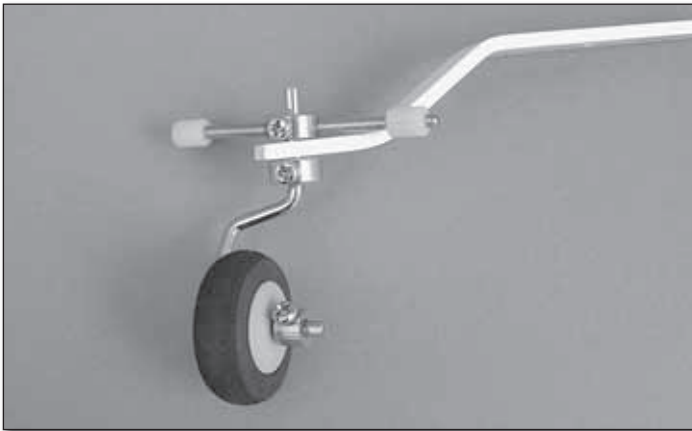
- ❑ 2. Install the large area wheel collar onto the tail wheel wire as shown.



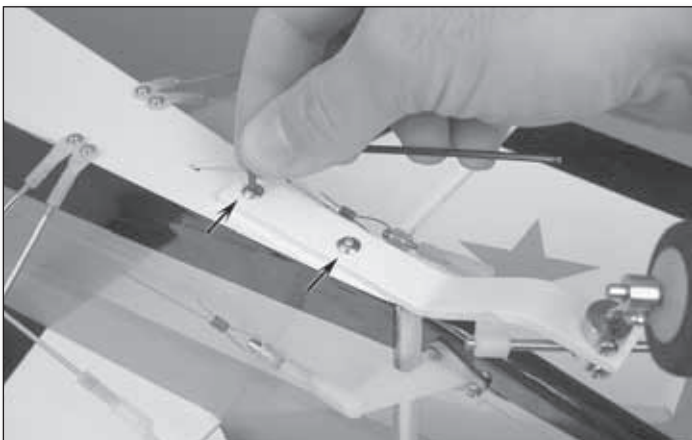
- ❑ 3. Fit the tail wheel wire onto the landing gear strap using the steering arm assembly on the top side. Position the steering arm collar so that the threaded arms are parallel with the axle. Remove the steering arm collar and file a flat spot in the tail wheel wire in that position. Install the wire to the landing gear strap using threadlocking compound on all screw threads.



❑ 4. Rotate the threaded joints until the center hole of the joint is approximately 1" [25mm] from the center of the tail wheel wire. Make each side equal. **Note:** You may want to adjust these later to get the tail wheel steering throw that better suits you.



❑ 5. Fit the 1-1/4" [32mm] tail wheel and attach it using the standard wheel collar. File a flat spot in the axle for the collar and use threadlocking compound on the locking screw.



❑ 6. Use the two (2) 4-40 x 1/2" [13mm] screws to attach the tail wheel landing gear to the fuselage. Apply threadlocking compound to the threads.

❑ 7. Turn your radio "ON" and center your rudder. Leave the radio on or lock the rudder in position while you set your tail wheel adjustment.



❑ 8. Install the tail wheel springs onto the tail wheel steering arms and connect them to the rudder control horns as shown. Bend the wire of the spring back onto itself and twist the ends of it around the wire. Cut off any excess wire.

❑ 9. Test the operation of the tail wheel using your radio.

❑ 10. Apply a couple drops of light machine oil to the axle.



## FINAL ASSEMBLY

### INSTALL THE COWL & PROPELLER

❑ 1. Install all engine accessories like the muffler, needle valve extension, throttle pushrod, and all fuel lines. If you didn't apply threadlocking compound to the engine mounting bolts, do so now. Check all mounting bolts for proper torque. Turn on your radio and do one final check to see that your throttle is rigged properly. Set your idle position per the engine manufacturer's specification.

❑ 2. Use some denatured alcohol to clean off any marks you made while trimming the cowl. Use the six (6) 1/2" [13mm] button head screws to attach the cowl.



❑ 3. Attach a 3-1/2" [89mm] spinner (not supplied) and a suitable propeller. Always balance your propeller (and spare props) using a prop balancer.

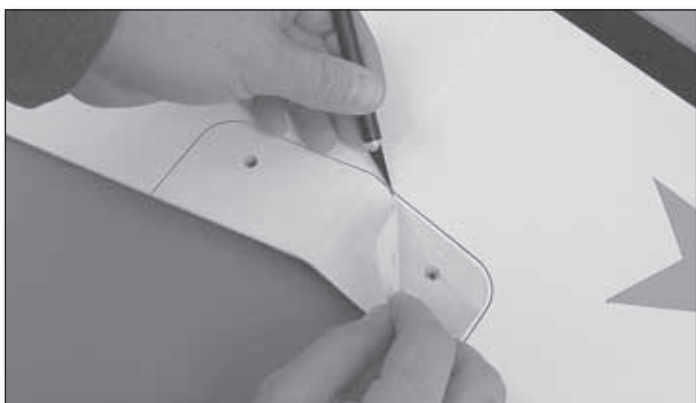


## WING INSTALLATION

- ❑ 1. Set your lower wing in position over the fuselage and tuck the extensions into the fuselage. Locate the wing reinforcement plate and the plastic wing bolts. Bolt the wing on with the reinforcement plate in position.

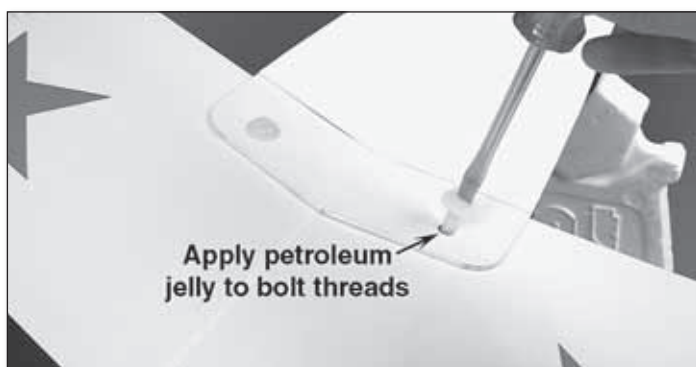


- ❑ 2. Trace the outline of the reinforcement plate onto the lower wing.



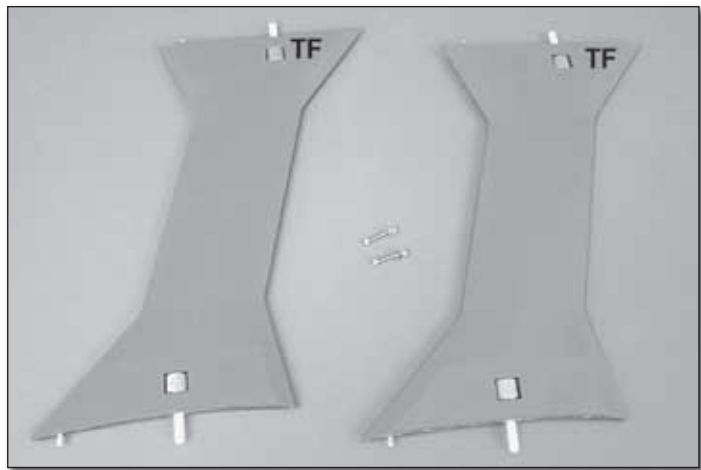
- ❑ 3. Remove the wing and trim the covering 1/8" [3.2mm] inside the line you traced. Peel off the covering so that the wood is exposed.

- ❑ 4. Lubricate the threads of the wing bolts with petroleum jelly. This will keep them from being glued in place in the next step. Mix up some 30-minute epoxy and thin it down with several drops of denatured alcohol.

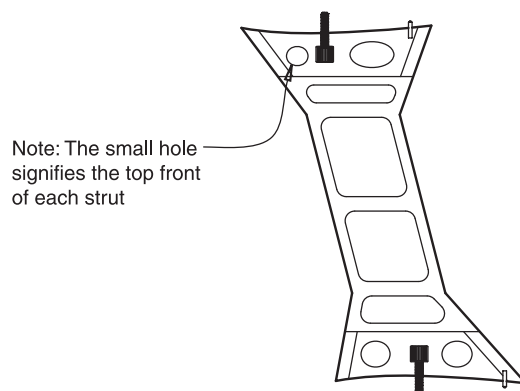


- ❑ 5. Set the wing back in position and connect your aileron servo leads in anticipation of the next section. Apply a thin

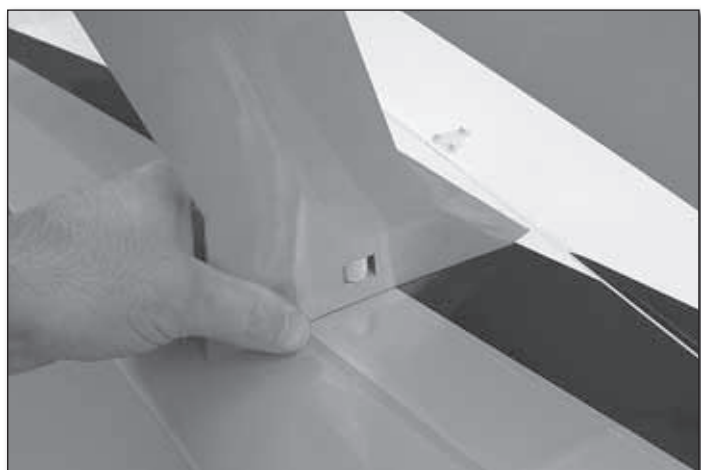
layer of 30-minute epoxy to the bottom of the reinforcement plate and set it in place. Glue the reinforcement plate in place by lightly snugging down the wing bolts. As a precaution, you can loosen and re-tighten the wing bolts in 15 minute intervals until the epoxy sets.



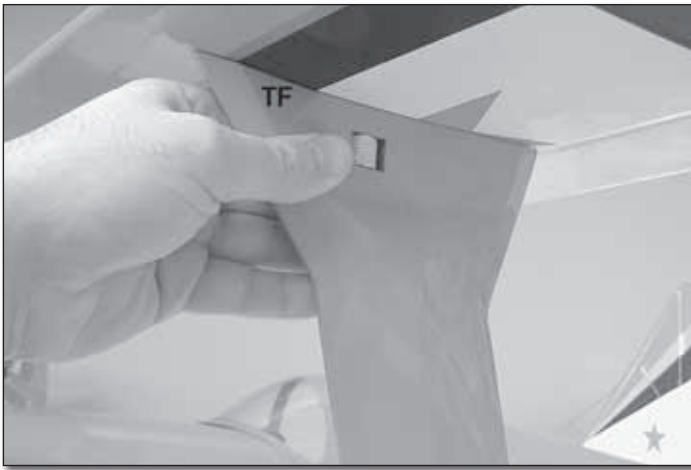
- ❑ 6. Locate the two (2) interplane wing struts, two (2) 4-40 x 3/4" [19mm] bolts, two (2) 4-40 self-locking nuts, and two (2) #4 washers.



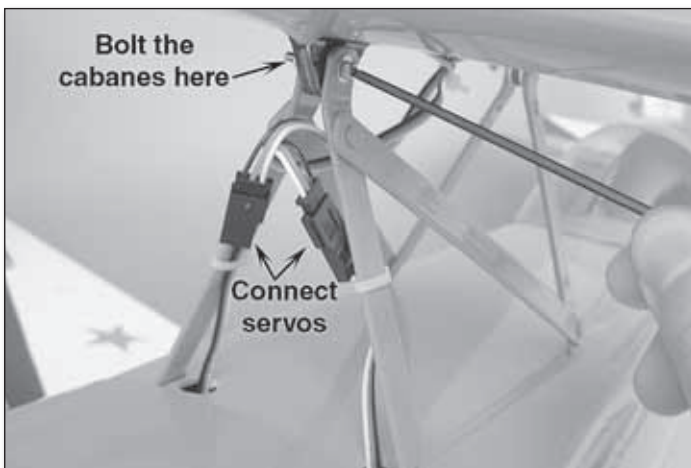
- ❑ 7. Identify the top front of each wing strut – look for the small lightening hole behind the covering. You may want to mark these with a felt-tip pen.



- ❑ 8. Install the interplane struts to the bottom wing finger-tight.



- ❑ 9. Set the top wing in position and thread the interplane struts into the top wing finger-tight.

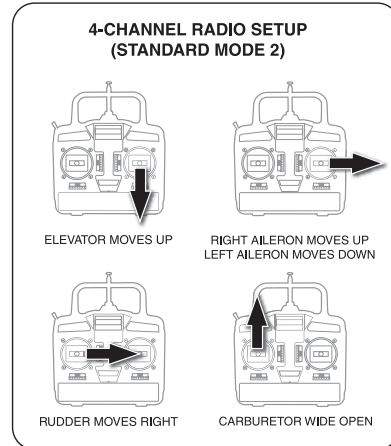


- ❑ 10. Bolt the top wing to the cabane struts using the two (2) 4-40 x 3/4" [19mm] bolts, two (2) 4-40 self-locking nuts, and two (2) #4 washers. Place the washers under the bolt heads.

- ❑ 11. Connect your upper wing servo wires.



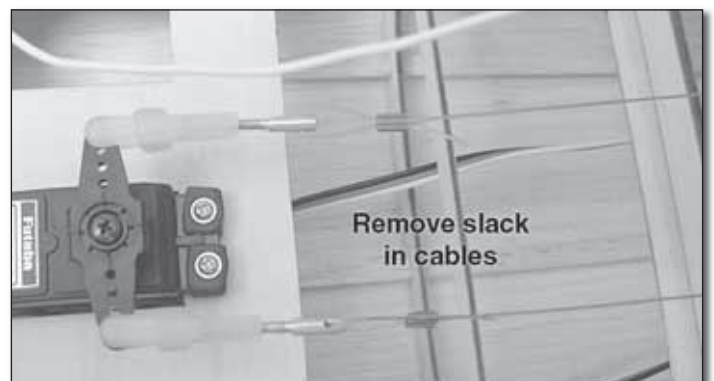
## SETTING CONTROL THROWS & DIRECTION



- ❑ 1. Turn your radio on and neutralize all of your trims. Check to see that your controls are operating in the correct direction by standing behind the model and moving the sticks. Reverse any servos using the servo reversing switches on your radio.



- ❑ 2. Neutralize (center) all control surfaces by adjusting the pushrod lengths at the clevises. Install the silicone retainers and check for free travel of each control surface.



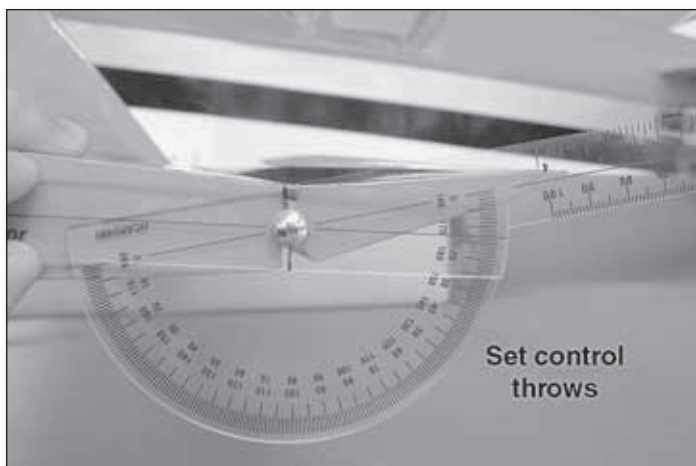
- ❑ 3. Pre-tension your rudder's pull-pull cable system by adjusting the clevises at the rudder. Keep the servo centered

and adjust the tension of both cables evenly. Tension the cables until there is no slack in the cables when you apply light pressure to the rudder with the servo fixed. Make sure that the rudder itself is still centered once you have the proper tension set. You should periodically inspect the pull-pull system for proper tension and general condition.



## C.G. BALANCING

Setting up your airplane with the proper C.G. and setting proper control throws are the most important things you can do to ensure that your airplane is safe. An airplane with improper C.G. and/or throws is unstable and can potentially be impossible to control. **IMPORTANT: Never neglect these procedures with any airplane! Take the time to properly balance and setup your model!**

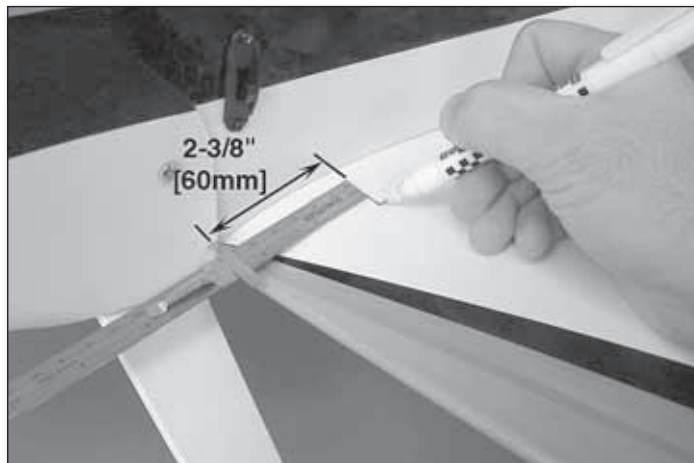


❑ 4. Set all of your control throws according to the chart below. If your radio does not have dual rates, we recommend starting out on the **low rates** for the first few flights and then moving up to the high rates. Use a builder's protractor or an inclinometer to help you achieve the proper throws.

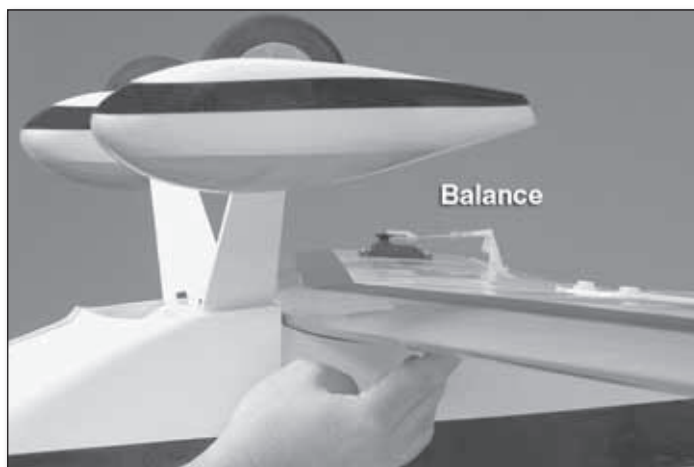
Set your throws mechanically by repositioning the linkages in the servo arms and/or the control horns and **THEN** fine-tune them with your transmitter's end-point feature.

### Settings:

	High Rate	Low Rate
<b>ELEVATOR:</b>	14° up 14° down	12° up 12° down
<b>RUDDER:</b>	23° right 23° left	15° right 15° left
<b>AILERONS:</b>	12° up 12° down	10° up 10° down



❑ 1. Measure 2-3/8" [60mm] back from the LE of the lower wing and make a mark. This will be where your model will need to balance. The forward C.G. limit is 1-7/8" [48mm] from the lower wing's LE. The aft C.G. limit is 2-7/8" [73mm] from the lower wing's LE. You may move your radio gear to help your plane balance, but make sure that it is secured properly.



❑ 2. Turn your model over and balance it on a suitable stand or using your fingertips. Use the stabilizer as your zero reference.

[illegible]

Date of First Flight: \_\_\_\_\_

Flight Notes: \_\_\_\_\_

[illegible]